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Natural History Contributions | Number 1

Rodents of the Calf Creek Local Fauna

(Cypress Hills Formation, Oligocene, Chadronian)
Saskatchewan

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Rodents of the Calf Creek Local Fauna (Cypress Hills Formation, Oligocene, Chadronian), Saskatchewan

by John E. Storer

With Illustrations by James S. McLean

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John E. Storer

The Calf Creek local fauna (Cypress Hills Formation, Chadronian) contains 17 taxa of rodents, including the new genus and species Cupressimus barbarae (Eomyidae). The rodent assemblage suggests an age late in the early Chadronian, definitely earlier than the middle Chadronian Pipestone Springs local fauna. Other evidence indicates that the age can be no earlier than that of the McCarty's Mountain local fauna.

(Rodentia: Oligocene: Saskatchewan)

INTRODUCTION

The rodents of the Cypress Hills Oligocene have been described recently (Russell 1972), based on teeth and jaws from several localities. This paper considers rodents from one local fauna, the Calf Creek local fauna (Holman 1972), collected at Saskatchewan Museum of Natural History (SMNH) Locality 6, in the north branch of Calf Creek, about 16 km (10 mi) northwest of Eastend, Saskatchewan.

SMNH Locality 6 is apparently identical with National Museum of Natural Sciences (NMC) Locality 117 (Hunter) and Royal Ontario Museum (ROM) Locality V-38. The site (data on file at SMNH) is "6 to 10 feet above sandstone layer 3640 [ft above mean sea level]? No consolidated material in this locality." (SMNH locality records.)

Amphibians, reptiles, and birds of the Calf Creek local fauna have been described by Holman (1963, 1968, 1972) and Weigel (1963). A variety of mammals (Russell 1972) are represented in the local fauna, including the giant creodont Hemipsalodon grandis (Russell 1938) and the anthracothere Bothriodon advena (Russell 1978).

This contribution is the first to describe part of a local fauna from the Cypress Hills Oligocene. It was intended that it form the basis for correlation of this local fauna, and thus serve as a reference point for the biostratigraphy of the formation. The remainder of the local fauna will be described in other papers.

This work also includes a revision of the taxonomy of many Cypress Hills rodents. Because the SMNH Calf Creek collection is the largest and most representative that has been available, I have come to conclusions that differ from those of other workers. Hopefully, taxonomic revision will clarify the nature of this major Chadronian fauna.

METHODS AND MATERIALS

Saskatchewan Museum of Natural History fossils considered here (prefix P) were collected from 1960 to 1964 by crews under the leadership of B.A. McCorquodale, including A.E. Swanston, A. Morrison, R.D. Weigel and O. Rillette; and in 1966 by A.E. Swanston and K. Prizeman. Fossils were separated from sand and gravel using a powered rotary screen, developed by McCorquodale and Swanston.

ROM and NMC specimens discussed in this paper are deposited in the respective Vertebrate Paleontology collections.

Illustrations were made by Mr. James S. McLean, Moose Jaw. Relative sizes of specimens are indicated by 1 mm scale bars.

All dental measurements are maxima for the crown and were taken with a Bausch and Lomb micrometer disc (no. 31-16-10) inserted in one eyepiece of an Olympus SZIII microscope. The micrometer disc was calibrated with a Bausch and Lomb stage micrometer (2 mm in intervals of 0.1 mm, 0.2 mm in intervals of 0.01 mm). Dental measurements are given to the nearest 0.01 mm.

Measurements of jaws were made with hand-held dial calipers (Fowler type 6921), and are given to the nearest 0.1 mm.

Measurements are given with descriptions, or in paragraph form. The object measured is given first, then the measurement (AP, anteroposterior diameter; BL, buccolingual diameter; BL met, buccolingual diameter of metalophid; BL hyp, buccolingual diameter of hypolophid), with number of specimens in parentheses and mean, observed range (OR) and coefficient of variation (CV).

SYSTEMATIC DESCRIPTION

Family Ischyromyidae

Leptotomus guildayi Black 1971

Prosciurus major Russell 1972, p.25

Referred specimens: $LM^{\underline{1}}$ or $M^{\underline{2}}$, ROM 6377; $RP^{\underline{4}}$, ROM 6284.

Discussion: These two teeth compare very closely in size, proportions, and dental morphology with *Leptotomus*

guildayi from Badwater (Black 1971). Russell (1972, p.25; fig. 7B,C) has presented excellent measurements and photographs of the specimens.

L. guildayi is not present in the SMNH collection, but one of the ROM specimens, ROM 6377 (holotype of Prosciurus major) was collected by Weigel and Holman in 1967, at the Calf Creek locality. L. guildayi is therefore included in the Calf Creek local fauna.

Ischyromys junctus Russell 1972

Referred specimens: $LP^{\overline{3}}$, P1585.185; $RP^{\overline{4}}$, P661.46; $LM^{\overline{1}}$ or $M^{\overline{2}}$, P661.47-49, P1585.188; $RM^{\overline{1}}$ or $M^{\overline{2}}$, P661.50-54; $LM^{\overline{3}}$, P661.79, P1585.189; $RM^{\overline{3}}$, P661.80; $LP_{\overline{4}}$, P661.55-57 P1585.282; $RP_{\overline{4}}$, P661.58, P1585.190; $LM_{\overline{1}}$ or $M_{\overline{2}}$, P661.59-63, P1585.191; $LM_{\overline{3}}$, P661.64, P1585.192; $RM_{\overline{3}}$, P1585.285.

Emended diagnosis: Small, approximately size of Ischyromys blacki. In lower molars, anterolophid and metalophid terminating against buccal side of metaconid, which connects them to single crest to apex of metaconid; this arrangement enclosing valley between anterolophid, metalophid, and metaconid; posterolophid forming a continuous curve around posterior margin of crown, reaching or almost reaching entoconid. $M^{\overline{1}}$, $M^{\overline{2}}$ with prominent metaconules, weaker protoconules; metalophs incomplete until advanced wear stages; hypocones weak; lingual valleys shallow.

Description: In $P^{\overline{3}}$ (Fig. 1A), the buccal cusp is far stronger than the lingual one, and the posterior valley is blocked by two sharp ridges. A low cingulum occupies the anterobuccal border of the crown.

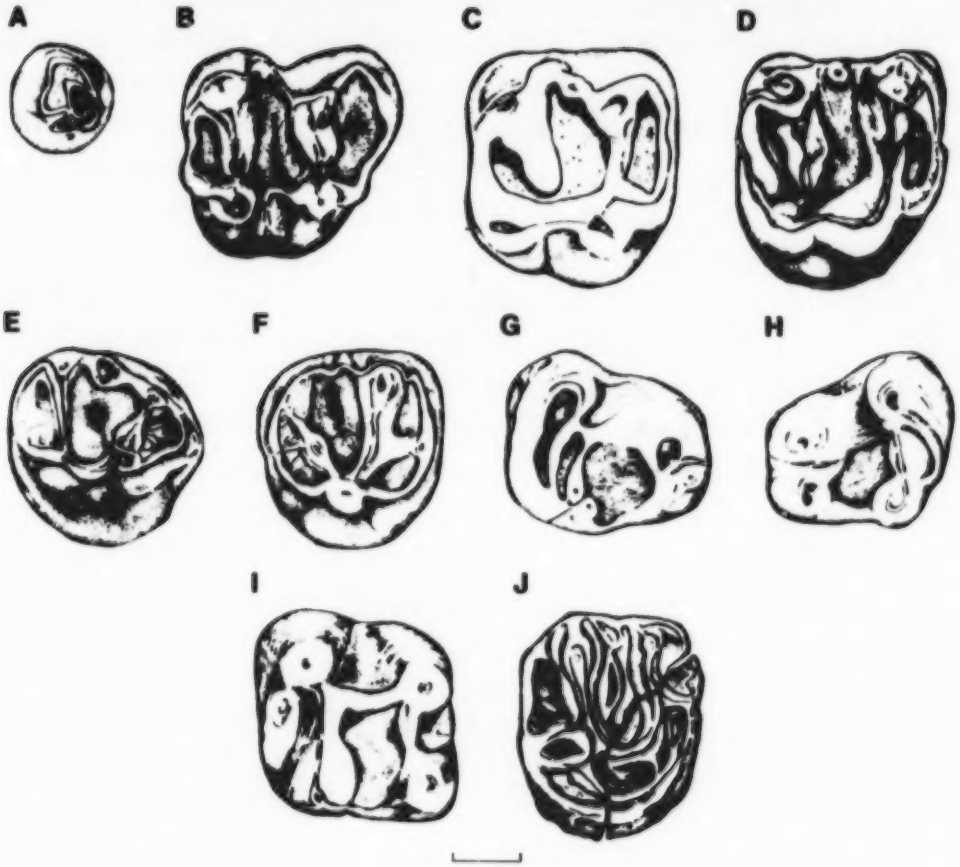

Fig. 1. Ischyromyidae. Buccal to top of page, anterior to left in A,E,G,I,J, to right in B-D,F,H. Scale 1 mm.

A-I. Ischyromys junctus. A, $LP\frac{3}{-}$, P1585.185; B, $RP\frac{4}{-}$, P661.46; C, $RM\frac{1}{-}$ or $M\frac{2}{-}$, P661.51; D, $RM\frac{1}{-}$ or $M\frac{2}{-}$, P661.52; E, $LM\frac{3}{-}$, P661.79; F, $RM\frac{3}{-}$, P661.80; G, $RP_{\frac{-}{4}}$, P661.57; H, $LP_{\frac{-}{4}}$, P661.58; I, $RM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P1585.191.

J. Ischyromyidae, gen. et sp. indet. $LM\frac{3}{-}$, P661.78.

The parastyle of $P^{\underline{4}}$ (Fig. 1B) is strong, and the ectoloph is M-shaped, with a weak mesostyle occurring between the paracone and metacone. Protocone and hypocone are of about equal size, and are separated by a wide valley. The protoloph and metaloph are strong, and are curved anterad, the paracone set slightly behind the protocone and the metacone slightly behind the hypocone.

$M^{\underline{1}}$ and $M^{\underline{2}}$ (Fig. 1C,D) show strong cingula, prominent mesostyles, and curved metalophs that are incomplete until advanced wear stages. Metaconules are prominent and protoconules weak, hypocones are weak and lingual valleys are very short.

$M^{\underline{3}}$ (Fig. 1E,F) is an elongate tooth with high ridges around its occlusal borders. A hypocone is developed, and is prominent in the unworn specimen at hand (Fig. 1E).

$P_{\overline{4}}$, $M_{\overline{1}}$, and $M_{\overline{2}}$ (Fig. 1G-I) are as described by Russell (1972, pp.28-29).

$M_{\overline{3}}$ (not shown) is an elongate tooth with complete metalophid and hypolophid, small mesoconid, and distinct elongate mesostylid.

Discussion: Assuming that these ischyromyid teeth belong to the same species (all are of appropriate size), Russell was quite correct in separating Ischyromys junctus from all other described species on the basis of dental pattern. I. junctus is one of the "primitive" Ischyromys, as are I. douglassi (Black 1968) and I. blacki (Wood 1974).

I. junctus is distinguished from other Ischyromys by the junction of the anterolophid and metalophid with the buccal side of the metaconid in lower molars (Russell

1972, p.28). This feature is consistently present in the six $M_{\overline{1}}$ or $M_{\overline{2}}$ in the SMNH collection. The height of the anterolophid is variable.

Lower cheek teeth also have long, curved posterolophids that reach, or nearly reach the entoconids. In some teeth, the posterolophid connects strongly with the entoconid, blocking the enclosed valley at its lingual end. In others, the valley between the hypolophid and posterolophid is broadly open at its lingual end. Likewise, in some specimens the cingulum that runs posteriorly from the metaconid is high and connects strongly with the entoconid, and in others the cingulum is low, leaving the talonid basin open lingually.

Upper molars show many of the "primitive" features (Wood 1974, p.25) listed for Ischyromys blacki; prominent metaconules and weaker protoconules, metalophs that would be incomplete until advanced wear stages, and relatively weak hypocones. The lingual valleys are weaker than in other Ischyromys except I. blacki.

Measurements:

$P^{\overline{3}}$, AP(1), 1.45; BL(1), 1.53. $P^{\overline{4}}$, AP(1), 3.04; BL(1), 3.16. $M^{\overline{1}}$ or $M^{\overline{2}}$, AP(5), mean 2.79, OR 2.60-3.08, CV 7.89; BL(6), mean 2.95, OR 2.68-3.36, CV 9.15. $M^{\overline{3}}$, AP(2), mean 2.84, OR 2.82-2.85; BL(2), mean 2.75, OR 2.73-2.76. $P_{\overline{4}}$, AP(5), mean 3.10, OR 2.80-3.32, CV 6.13; BL met (5), mean 2.09, OR 1.88-2.34, CV 8.13; BL hyp (4), mean 2.48 OR 2.46-2.52. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(5), mean 3.08, OR 2.90-3.40, CV 6.49; BL met (5), mean 2.86, OR 2.72-3.12, CV 5.59; BL hyp (5), mean 2.88, OR 2.72-3.12, CV 5.90. $M_{\overline{3}}$, AP(1), 3.08; BL met (2), mean 2.67, OR 2.41-2.92; BL hyp (3), mean 2.45, OR 2.04-2.84.

Ischyromyidae, gen. et sp. indet.

Referred Specimen: LM^{3}, P661.78 (Fig. 1J)

Description: The mesostyle and hypocone are small but distinct, anterior and posterior cingula strong, with strong cross-connections to the proto-and metaloph, the anterior cingulum connecting strongly to the paracone. A basin, enclosed by the posterior cingulum, lies posterior to the metacone. The paracone is much larger and higher than the metacone, the protoloph is complete, apparently with a large protoconule, the metaconule is large and double, the metaloph incomplete, and the valley between proto-and metaloph narrow, shallow, and curved posterad in the middle of the tooth. The crown was apparently mesodont. Measurements: AP, 2.61; BL, 3.18.

Discussion: This worn tooth evidently represents an ischyromyid (paramyid, sensu Wood 1962). It does not show the unilateral hypsodonty characteristic of cylindrodontids. The basin posterior to the metacone indicates that the tooth is M^{3}.

I cannot place this tooth definitely in any of the described ischyromyid genera, although an argument could be made in favour of Rapamys (see Black 1971, esp. fig. 32).

Family Cylindrodontidae

Pseudocylindrodon neglectus Burke 1935

Referred specimens: LdP^{4}, P1585.27; RP^{4}, P1585.1-3; LM^{1} or M^{2}, P661.3, P1585.4-9; RM^{1} or M^{2}, P661.4, P1585.10-15; LM^{3}, P1585.16-17; RM^{3}, P1585.18-20, LdP_{4}, P1585.21; LP_{4}, P1585.22; RP_{4}, P1585.23-24; RM_{1} or M_{2}, P1585.25; RM_{3}, P1585.26.

Description: Cheek teeth are mesodont, show unilateral hypsodonty, and are broader than long when unworn, except $dP_{\overline{4}}$ and $P_{\overline{4}}$. The central valley forms a shallow pit that is blocked buccally in upper teeth by a strong mesostyle or cingulum (Fig. 2A-D), and lingually in lower teeth by a mesostylid that is strongly connected to the metaconid (Fig. 2E,F).

Discussion: These teeth are so similar in size and occlusal pattern to Pseudocylindrodon neglectus that I have no hesitation in assigning them to the Pipestone Springs species. Strong mesostyles and mesodont crowns resemble features of P. neglectus, and differ from P. medius.

Measurements: $dP^{\underline{4}}$, AP(1), 1.88; BL(1), 2.05. $P^{\underline{4}}$, AP(2), mean 1.56, OR 1.52-1.59; BL(2), mean 2.08, OR 2.01-2.15; $M^{\underline{1}}$ or $M^{\underline{2}}$, AP(12), mean 1.67, OR 1.47-1.87, CV 7.19; BL(12), mean 2.25, OR 2.04-2.37, CV 6.67. $M^{\underline{3}}$, AP(5), mean 1.59, OR 1.51-1.65, CV 3.77; BL(5), mean 1.86, OR 1.73-2.01, CV 5.91. $dP_{\overline{4}}$, AP(1), 1.61; BL(1), 1.53. $P_{\overline{4}}$, AP(3), mean 1.91, OR 1.72-2.07; BL(3), mean 1.86, OR 1.80-1.97. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(1), 1.57; BL(1), 1.85. $M_{\overline{3}}$, AP(1), 1.53; BL(1), 1.73.

Cylindrodon collinus Russell 1972
Prosciurus altidens Russell 1972, p. 26

Referred specimens: $LP^{\underline{4}}$, P661.5; $LM^{\underline{1}}$, P661.6-14, P661.141, P1585.28-49, P1585.493; $RM^{\underline{1}}$ or $M^{\underline{2}}$, P661.15-19; P661.142, P1585.50-73, P1585.494; $LM^{\underline{3}}$, P1585.74-80; $RM^{\underline{3}}$, P1585.81-87; $LdP_{\overline{4}}$, P1585.88-89; $RdP_{\overline{4}}$, P1585.90-93; $LP_{\overline{4}}$, P661.20, P1585.94-100, P1585.495, P1585.615; $RP_{\overline{4}}$, P661.21-23,

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Fig. 2. Pseudocylindrodon and Cylindrodon. Buccal to top of page, anterior to left in A,F-M,O,P,S-U, X,Y, to right in B-E,N,Q,R,V,W. Scale 1 mm.
A-F. Pseudocylindrodon neglectus. A, $LdP^{\underline{4}}$, P1585.27; B, $RP^{\underline{4}}$, P1585.3; C, $RM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.10; D, $RM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.15; E, $LP_{\overline{4}}$, P1585.22; F, $RM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.25.
G-Y. Cylindrodon collinus. G, $LP^{\underline{4}}$, P661.5; H, H, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P661.7; I, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P661.8; J, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P661.11; K, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.12; L, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.33; M, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.45; N, $RM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.50; O, $LM^{\underline{3}}$, P1585.75; P, $LM^{\underline{3}}$, P1585.76; Q, $RM^{\underline{3}}$, P1585.81; R, $LdP_{\overline{4}}$, P1585.88; S, $RP_{\overline{4}}$, P661.22; T, $RP_{\overline{4}}$, P1585.101; U, $RP_{\overline{4}}$, P1585.105; V, $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.112; W, $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.114; X, $RM_{\overline{3}}$, P1585.173; Y, $RM_{\overline{3}}$, P1585.174.

P1585.101-109; $LM_{\overline{1}}$ or $M_{\overline{2}}$, P661.24-28, P1585.110-134, P1585.496; $RM_{\overline{1}}$ or $M_{\overline{2}}$, P661.29-33, P1585.135-152, P1585.497; $LM_{\overline{3}}$, P1585.153-160; $RM_{\overline{3}}$, P1585.161-183; L. mandibular fragment with alveoli for $M_{\overline{1-3}}$, P661.34, P661.36; L. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.35; R. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.37; R. mandibular fragment with $M_{\overline{1-3}}$, P661.38; R. mandibular mandibular fragment with $M_{\overline{2}}$, alveoli for $M_{\overline{1}}$, $M_{\overline{3}}$, P661.39; R. mandibular fragment with $M_{\overline{2}}$, alveolus for $M_{\overline{3}}$, P661.40; R. mandibular fragment with alveolus for $P_{\overline{4}}$, P661.41; R. mandibular fragment with alveoli for $M_{\overline{1-3}}$, P661.42; R. mandibular fragment with alveoli for $M_{\overline{2-3}}$, P661.43.

Emended diagnosis: Larger than Cylindrodon fontis; cheek teeth hypsodont, showing marking unilateral hypsodonty; $P_{\overline{4}}$ protoconid and metaconid separated by distinct valley, metaconid larger than protoconid, trigonid basin oriented anteroposteriorly; $M_{\overline{1-3}}$ hypoconulid indistinct, metalophid usually transverse rather than anterolingually oblique; $M_{\overline{3}}$ hypolophid, posterior cingulum long and complete.

Description: Cheek teeth are hypsodont, and show marked unilateral hypsodonty. Molar crowns of unworn teeth are rectangular or oval in occlusal outline, and are longer than wide: with increasing wear, teeth become wider than long, except $M^{\overline{3}}$, which becomes as wide as long.

The only $P^{\overline{4}}$ (Fig. 2G) is heavily worn. It is nearly square in outline, with transverse lophs, and a narrow trench separating the paracone and parastyle.

Unworn $M^{\overline{1-2}}$ (Fig. 2H-J,M) are nearly rectangular in outline, long axis anteroposterior: with wear the occlusal

outline becomes square (Fig. 2K,L), then rectangular, long axis transverse. The metaloph has a prominent metastyle, and a low connection with the protocone. A strong cingulum, which may be continuous (Fig. 2M) or notched, and sometimes carries a mesostyle (Fig. 2L,N) joins the paracone and metacone, and the posterior cingulum is nearly straight or gently curved along the posterior margin. With wear, the anterior and posterior valleys of most teeth split into lingual and buccal lakes.

$M^{\underline{3}}$ (Fig. 2O-Q) is the smallest tooth in the upper series. Unworn, it is ovoid-triangular in occlusal outline; with wear $M^{\underline{3}}$ shortens considerably in anteroposterior diameter, broadening somewhat, and taking on a triangular outline. Russell, I believe, described two $M^{\underline{3}}$'s as supposed $P^{\underline{4}}$'s (1972, p.31), and his description applies to the SMNH specimens as well. The metaloph of $M^{\underline{3}}$ is always complete, or nearly so, and joins high on the protocone; as in $M^{\underline{1-2}}$, the cingulum that joins the paracone and metacone may be continuous or notched, and insome specimens bears a mesostyle.

$dP_{\underline{4}}$ (Fig. 2R) is long and slender, wider posteriorly than anteriorly. In SMNH P1585.88, the protoconid and metaconid are joined posteriorly and anteriorly with a transversely elongate trigonid basin between them. The hypolophid is a strong, continuous crest that joins the hypoconid, and the posterolophid is set off from the hypoconid and entoconid by shallow clefts. Other specimens of $dP_{\underline{4}}$ show an anteroposterior valley separating the protoconid and metaconid.

The mandible and worn lower permanent detition have been described by Russell (1972, pp.32-33), and the following description will be confined to unworn teeth.

In $P_{\overline{4}}$ (Fig. 2S-U), the protoconid and metaconid are separated by a distinct valley. The metaconid is larger than the protoconid, and the trigonid basin is oriented anteroposteriorly. The hypolophid joins the entoconid low on its buccal surface in P661.22. In other specimens the hypolophid is strong, and comes to the occlusal surface.

In $M_{\overline{1-2}}$ (Fig. 2V,W), the posterior cingulum may curve evenly, fusing with the entoconid, although in most specimens it meets a buttress from the entoconid, and the hypoconulid is indistinct. The metalophid, as Russell (1972, p.31) pointed out, is transverse, and the hypolophid is low. In some specimens, the anterior cingulum is low, or broken by the anterior end of the trigonid basin.

The talonid of $M_{\overline{3}}$ (Fig. 2X,Y) is generally as wide as the trigonid. The hypolophid and posterior cingulum are long and complete.

Discussion: Teeth of Cylindrodon collinus bear an extremely close resemblance to those of C. fontis. Although size ranges of the species overlap, C. collinus is statistically larger, and mean size and minor features of occlusal pattern separate the species.

Prosciurus altidens (Russell 1972, p.26) I regard as a synonym of C. collinus. The holotype $RP^{\overline{4}}$, ROM 6285, is unilaterally hypsodont, and has loph arrangements as in C. collinus. I include ROM 6285 and referred specimens ROM 6378 and 6286 in the species.

I have refrained from invoking page priority in applying the trival name altidens to C. collinus, to avoid confusion.

Measurements: $P^{\underline{4}}$, AP(1), 2.23; BL(1), 2.41. $M^{\underline{1}}$ or $M^{\underline{2}}$, AP(41), mean 1.95, OR 1.72-2.40, CV 7.69; BL(41), mean 2.09, OR 1.64-2.67, CV 11.48. $M^{\underline{3}}$, AP(14), mean 1.73, OR 1.30-2.07, CV 11.56; BL(14), mean 1.60, OR 1.26-1.92, CV 11.88. $dP_{\overline{4}}$(7), mean 2.09, OR 1.93-2.21, CV 4.78; BL(7), mean 1.63, OR 1.49-1.78, CV 6.13. $P_{\overline{4}}$, AP(16), mean 2.09, OR 1.93-2.37, CV 6.22; BL(15), mean 1.97, OR 1.69-2.16, CV 8.63; $M_{\overline{1}}$, AP(1), 2.07; BL(1), 2.23. $M_{\overline{2}}$, AP(3), mean 2.29, OR 2.19-2.34; BL(3), mean 2.25, OR OR 2.21-2.29. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(33), mean 2.08, OR 1.74-2.40, CV 8.17; BL(33), mean 2.04, OR 1.68-2.40, CV 8.82. $M_{\overline{3}}$, AP(26), mean 1.90, OR 1.77-2.10, CV 5.26; BL(26); mean 1.67, OR 1.59-1.79, CV 5.99.

Ardynomys saskatchewensis (Lambe) 1908

Sciurus? saskatchewensis Lambe 1908, p.55

Prosciurus saskatchewanensis Russell 1934, pp.56-67

Prosciurus saskatchewaensis Wood 1937, p.169; 1962, p.232

Prosciurus saskatchewensis Russell 1972, pp.20-23

Holotype: $RM^{\underline{1}}$ or $M^{\underline{2}}$, NMC 6479

Referred specimens: $RM^{\underline{1}}$ or $M^{\underline{2}}$, P661.44; L. maxillary fragment with alveoli for alveoli for $P^{\underline{3-4}}$, $M^{\underline{1-2}}$, P661.45.

Emended diagnosis: Size of Ardynomys occidentalis; anterior and posterior cingula meet paracone and metacone, closing off valleys; protoconule absent, protoloph stout, complete; metaconule single, large, distinct, metaloph complete but low near protocone; strong cross-connection between metaconule and posterior cingulum; hypocone small; metaloph broader than protoloph.

Description: The holotype has been described many times. I will let the emended diagnosis stand for the description here.

$RM^{\underline{1}}$ or $M^{\underline{2}}$ (Fig. 3A), P661.44, is very worn and shows no trace of the occlusal pattern. It was evidently low-crowned, and is much broader than long. Measurements: AP, 2.10; BL, 2.94.

The left maxillary fragment (Fig. 3B) shows the alveolus for $p^{\underline{4}}$ nearly as broad as that for $M^{\underline{1}}$, and the $M^{\underline{1}}$ aveolus broader than that for $M^{\underline{2}}$.

Discussion: I am somewhat at a loss as to the proper assignment of these specimens. The holotype, NMC 6479 (an excellent photograph is given by Russell 1972, fig. 5D), is a cylindrodontid, because of its unilateral hypsodonty, straight anteroposterior protocone-hypocone connection, relatively deep central basin, and strong posterior cingulum connecting with the metacone well linguad of the buccal wall.

The degree of development of the hypocone is greater than one would expect in Pseudocylindrodon, but is comparable to that seen in Ardynomys (Wood 1974, fig. 22C) Moreover, if maxillary fragment P661.45 is correctly referred to this species, $M^{\underline{1}}$ is much broader than $M^{\underline{2}}$, a distinctive characteristic of Ardynomys.

Although Ardynomys saskatchewensis is close in size and many features of occlusal pattern to A. occidentalis, I here recognize it as a separate species. Its strong anterior and posterior cingula that close off valleys, large, distinct metaconule, metaloph very low near protocone, and metaloph broader than protoloph, distinguish at least the holotype from A. occidentalis.

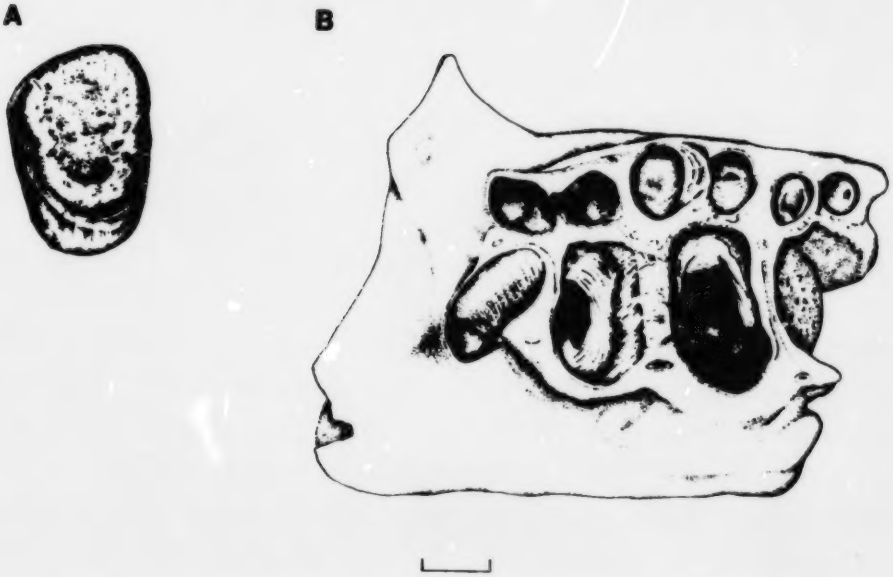

Fig. 3. Ardynomys saskatchewensis. Buccal to top of page, anterior to left in B, to right in A. Scale 1 mm. A, $RM^{\underline{1}}$ or $M^{\underline{2}}$, P661.44; B, L. maxillary fragment with alveoli for $LP^{\underline{3-4}}$, $LM^{\underline{1-2}}$, P661.45.

Although the holotype, and thus the species is definitely cylindrodontid, I do not think that any of the specimens referred by Russell (1972, p.20) belongs to this taxon. The ROM and NMC specimens seem to me to represent Ischyromys junctus, Prosciurus vetustus, and Protosciurus jeffersoni.

Family Aplodontidae

Prosciurus vetustus Matthew 1903

Prosciurus minor Russell 1972, pp.23-24

Referred specimens: $LdP^{\frac{4}{-}}$, P1585.193; $LP^{\frac{4}{-}}$, P1585.194-197; $RP^{\frac{4}{-}}$, P1585.198-202; $LM^{\frac{1}{-}}$ or $M^{\frac{2}{-}}$, P1585.203-212; $RM^{\frac{1}{-}}$ or $M^{\frac{2}{-}}$, P661.65, P1585.213-225; $LM^{\frac{3}{-}}$, P661.66, P1585.226; $RM^{\frac{3}{-}}$, P1585.277-228; $RdP_{\frac{-}{4}}$, P1585.229; $LP_{\frac{-}{4}}$, P661.68, P1585.230-233; $RP_{\frac{-}{4}}$, P661.69, P1585.234-237; $LM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P661.70-71, P1585.238-247; $RM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P661.72, P661.392-393, P1585.248-262; $LM_{\frac{-}{3}}$, P1585.262-272; $RM_{\frac{-}{3}}$, P1585.273-276; L. maxillary fragment with alveoli for $P^{\frac{3}{-}}$-$M^{\frac{2}{-}}$, P661.391; R. maxillary fragment with alveoli for $P^{\frac{3}{-}}$-$M^{\frac{1}{-}}$, P661.67; R. mandibular fragment with alveoli for $P_{\frac{-}{4}}$-$M_{\frac{-}{1}}$, P661.73.

Description: In upper cheek teeth (Fig. 4A-E), protocones are constricted anteroposteriorly and rise to sharp peaks, metalophs are constricted and fuse with protocones near their bases, mestyles are weak to prominent, metaconules are usually double, sometimes single, and protoconules are of medium to large size.

Lower cheek teeth (Fig. 4F) show large mesoconids that send prominent ridges to the buccal edges of the

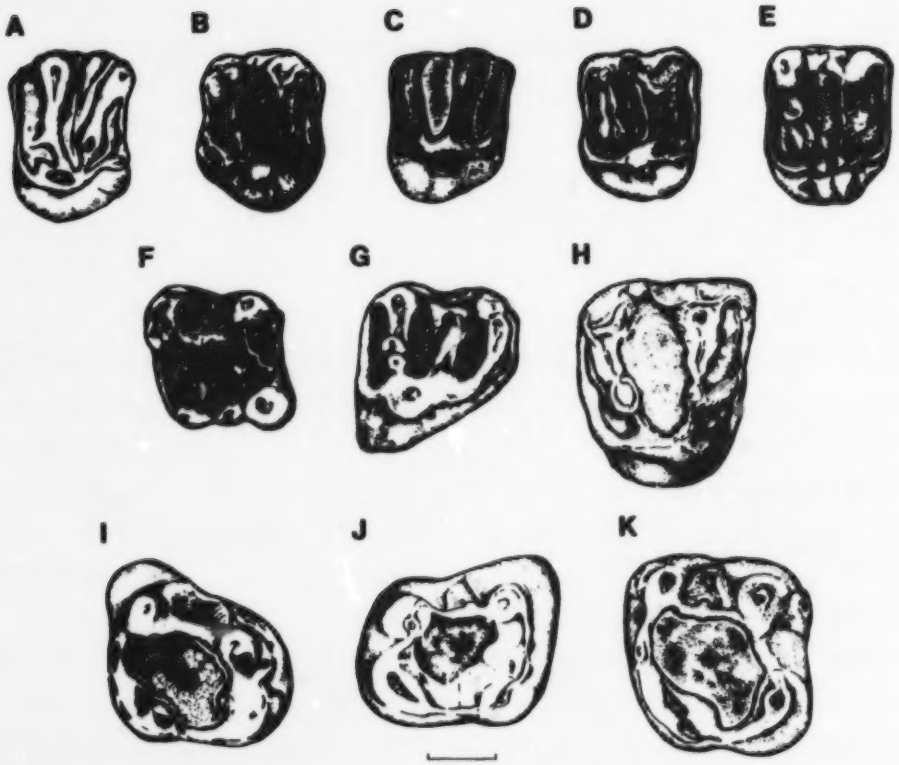

Fig. 4. Prosciurus and Protosciurus. Buccal to top of page, anterior to left in A,J, to right in B-I, K. Scale 1 mm.

A-F. Prosciurus vetustus. A, $LM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P1585.204; B, $RM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P1585.219; C, $RM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P1585.222; D, $RM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P1585.223; E, $RM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P1585.225; F, $LM_{\frac{}{1}}$ or $M_{\frac{}{2}}$, P1585.240.

G-K. Protosciurus jeffersoni. G, $RdP^{\frac{4}{}}$, P1585.278; H, $RM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P661.77; I, $LP_{\frac{}{4}}$, P661.81; J, $RP_{\frac{}{4}}$, P661.82; K, $LM_{\frac{}{1}}$ or $M_{\frac{}{2}}$, P661.86.

crowns. Hypolophids in $P_{\overline{4}}$-$M_{\overline{2}}$ are short, and merge with the posterolophids.

Discussion: These specimens agree with Prosciurus vetustus from Pipestone Springs in size and characteristics.

Prosciurus minor (Russell 1972, pp.23-24) seems referable to P. vetustus as well. The type, ROM 6287, has a double metaconule, and is of appropriate size to refer here. Referred specimens are within the expected range of variation.

Measurements: $dP^{\overline{4}}$, AP(1), 1.68; BL(1), 1.89. $P_{\overline{4}}$, AP(9), mean 1.87, OR 1.72-2.07, CV 6.95; BL(8), mean 2.12, OR 1.90-2.25, CV 5.19. $M^{\overline{1}}$ or $M^{\overline{2}}$, AP(21), mean 1.86, OR 1.68-2.11, CV 5.91; BL (21), mean 2.31, OR 1.92-2.61, CV 7.36. $M^{\overline{3}}$, AP(3), mean 2.05, OR 1.95-2.23; BL(2), mean 2.12, OR 2.02-2.22. $dP_{\overline{4}}$, AP(1), 1.75; BL met (1), 1.20; BL hyp(1) 1.50. $P_{\overline{4}}$, AP(8), mean 1.82, OR 1.65-2.01, CV 6.56; BL met (9), mean 1.46, OR 1.17-1.62, CV 10.27; BL hyp (8), mean 1.73, OR 1.51-1.85, CV 8.67. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(22), mean 1.98, OR 1.74-2.29, CV 7.58; BL met (2) mean 1.90, OR 1.57-2.31, CV 10.00; BL hyp(23), mean 1.98, OR 1.65-2.25, CV 7.58. $M_{\overline{3}}$, AP(9), mean 2.18, OR 1.89-2.40, CV 7.80; BL met(11), mean 2.03, OR 1.83-2.29, CV 8.37; BL hyp (12), mean 1.78, OR 1.47-1.98, CV 7.30.

Family Sciuridae

Protosciurus jeffersoni (Douglass) 1901

Referred specimens: $LdP^{\overline{4}}$, P1585.277; $RdP^{\overline{4}}$, P661.74, P1585.278; $LP^{\overline{4}}$, P661.75, P1585.279; $LM^{\overline{1}}$ or $M^{\overline{2}}$, P661.76; $RM^{\overline{1}}$ or $M^{\overline{2}}$, P661.77, P1585.280-281; $LP_{\overline{4}}$, P661.81; $RP_{\overline{4}}$,

P661.82-83; $LM_{\overline{1}}$ or $M_{\overline{2}}$, P661.84-87, P1585.283-284; $RM_{\overline{1}}$ or $M_{\overline{2}}$, P661.88-89.

Tentatively referred: $LP^{\overline{3}}$, P1585.187.

Description: Three specimens are assigned to $dP^{\overline{4}}$ (Fig. 4G) because of their low crown heights. These teeth are roughly triangular in occlusal outline, with small, low mesostyles and low but distinct paraconids and metaconids. The protoloph and metaloph are not much constricted where they meet the protocone, and the metaloph sends low ridges into the small basin enclosed by the posterior cingulum. The metaconule of one specimen is double. Length of $dP^{\overline{4}}$ equals width.

Both $P^{\overline{4}}$'s are badly worn. The mesostyle was evidently low but distinct, and the protoloph and metaloph were low and not greatly constricted.

$M^{\overline{1}}$ or $M^{\overline{2}}$ (Fig. 4H) is nearly rectangular in outline, with a low, distinct mesostyle, and low lophs. The protoconid and metaconid are distinct in a little-worn specimen, and the lophs are somewhat constricted where they meet the protocone.

Lower cheek teeth (Fig. 4I-K) show small mesostylids and large mesoconids. Protoconids and entoconids are small. Molars show complete metalophids, and metaconids that are buccally directed, and overhang the trigonid basins. $M_{\overline{1-2}}$ are roughly rhomboidal in shape.

Discussion: The lower teeth are identical to those of Protosciurus jeffersoni, as described by Black (1965, pp. 19-21) in size and occlusal pattern.

Upper cheek teeth in this sample are of appropriate size and pattern to be referred to the same species as the

lowers. They are somewhat different from upper cheek teeth of P. jeffersoni described by Black, in the shape of $P^{\underline{4}}$, and in the occlusal widths of $P^{\underline{4}}$-$M^{\underline{2}}$. Cusps are in the same locations, the metacones and paracones set well in from the parastyles and mesostyles.

Measurements: $P^{\underline{3}}$, AP(1), 1.26; BL(1), 1.53. $dP^{\underline{4}}$, AP(3), mean 2.42, OR 2.35-2.52; BL(3), mean 2.44, OR 2.40-2.49. $P^{\underline{4}}$, AP(1), 2.69; BL(1), 2.78. $M^{\underline{1}}$ or $M^{\underline{2}}$, AP(1), 2.60; BL(1), 3.04. $P_{\overline{4}}$, AP(3), mean 2.80, OR 2.76-2.85; BL met (2), mean 2.30, OR 2.25-2.34; BL hyp (2), mean 2.64, OR 2.64-2.64. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(3), mean 2.77, OR 2.64-2.97: BL met (3), mean 2.52, OR 2.48-2.60; BL hyp (3), mean 2.75, OR 2.70-2.82.

Family Eomyidae

Adjidaumo minimus (Matthew) 1903

Referred specimens: L. mandibular fragment with $P_{\overline{4}}$, alveoli for $M_{\overline{1}-\overline{3}}$, P661.92; L. mandibular fragment with $P_{\overline{4}}$-$M_{\overline{3}}$, P661.93; L. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.94-95; R. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{2}}$, P661.96; R. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.97; L. mandibular fragment with alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.98; R. mandibular fragment with alveoli for $M_{\overline{2}-\overline{3}}$, P661.99; L. mandibular fragment with alveolus for $M_{\overline{3}}$, P661.100.

Description: Mandible P661.92 is long and slender (depth beneath $P_{\overline{4}}$, 2.7), with the mental foramen lying nearly on the dorsal surface anterior to $P_{\overline{4}}$: the coronoid process intersects the base of the tooth row at a gentle angle, just posterior to $M_{\overline{2}}$.

In mandible P661.93 (Fig. 5A), the depth of the mandible beneath $P_{\overline{4}}$ is approximately 2.4, and the coronoid process intersects the base of the tooth row at a steeper angle, just posterior to $M_{\overline{2}}$.

In $P_{\overline{4}}$, P661.92, the lophids are somewhat higher than in the type specimen (Black 1965, fig. 5e), but the posterior cingulum is short and weak. The mesolophid extends nearly to the lingual border, and its lingual end is free. Measurements: AP, 0.87; BL met. 0.57; BL hyp, 0.74.

$P_{\overline{4}}$ in P661.93 does not show much detail, but it has a low, short posterior cingulum. In $M_{\overline{1}-\overline{2}}$, anterior cingula are joined to the bases of the metaconids: in $M_{\overline{1}}$, the buccal end of the anterior cingulum is free. Mesolophids are short, reaching only half way to the lingual border, and their lingual ends are free.

$M_{\overline{3}}$ has no posterior cingulum, and the anterior cingulum is connected by a short crest to the metalophid. Measurements P661.93 dental series: $P_{\overline{4}}$, AP, 0.95; BL met, 0.60; BL hyp, 0.79. $M_{\overline{1}}$, AP, 1.02; BL met, 0.86; BL hyp, 0.90. $M_{\overline{2}}$, AP, 10.02; BL met, 0.99, BL hyp, 0.90. $M_{\overline{3}}$, AP, 0.96.

Mandibular measurements: alveolar length $P_{\overline{4}}$-$M_{\overline{1}}$(6), mean 4.0, OR 3.8-4.1, CV 2.0; length of diastema (5), mean 2.7, OR 2.5-3.4, CV 13.7; depth below $M_{\overline{1}}$(7), mean 2.8, OR 2.4-3.0, CV 7.9

Disucssion: These specimens represent the smallest of the Calf Creek eomyids. Size, patterns, proportions, and height of crown are those of Adjidaumo minimus.

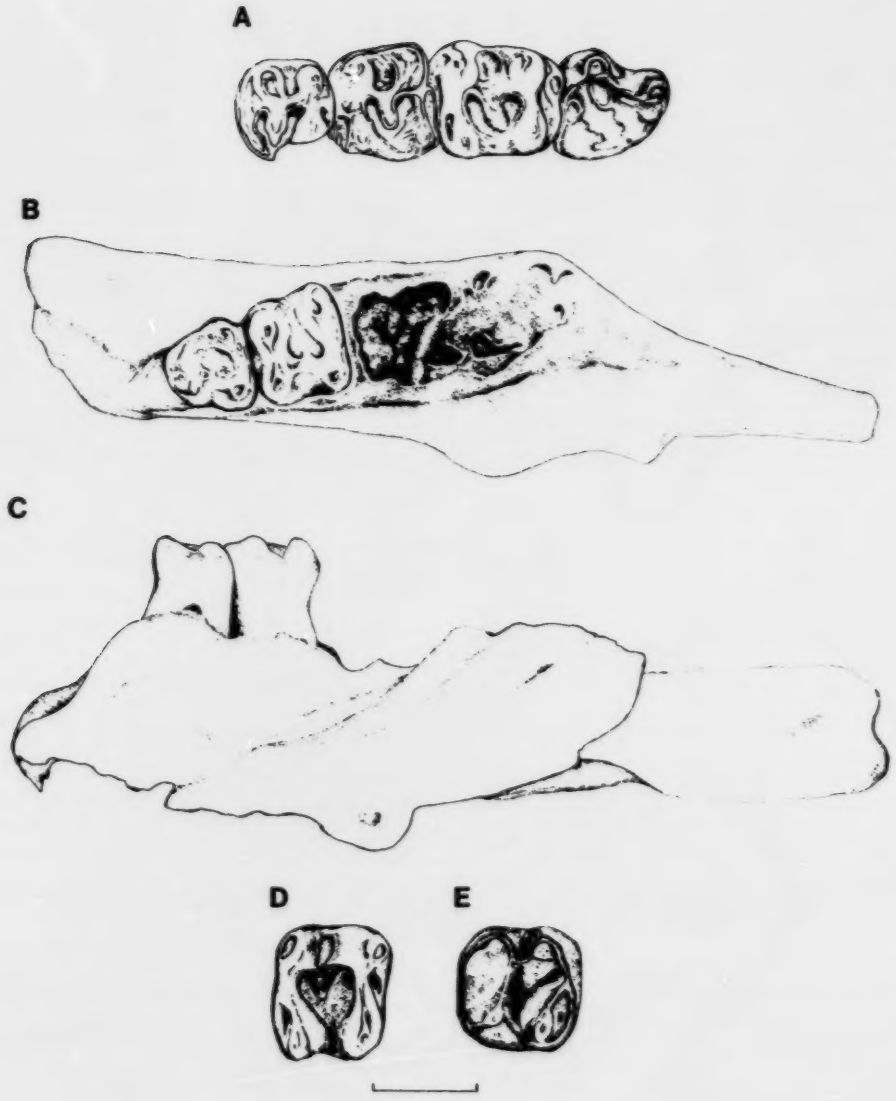
A
B
C
D
E

Fig. 5. Adjidaumo and Cupressimus. Scale 1 mm.
A. Adjidaumo minimus. $LP_{\overline{4}}$, $LM_{\overline{1}-\overline{3}}$, P661.93, buccal to top of page, anterior to right.
B, C. Cupressimus barbarae. L. mandibular fragment with $LP_{\overline{4}}$, $LM_{\overline{1}}$ P661.101 (holotype). B. occlusal view, buccal to bottom of page, anterior to left; C, lateral view, occlusal to top of page, anterior to left.
D, E. Cupressimus barbarae. D, $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.286, buccal to top of page, anterior to right; E, $RM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.288, buccal to top of page, anterior to left.

Cupressimus barbarae, gen. et sp. nov.

Derivation: Genus Latin *cupressus* (cypress) + *mus* (mouse). Trivial name in honour of my wife, Barbara.

Diagnosis of genus: $P_{\overline{4}}$, $M_{\overline{1}}$ brachydont, nearly equidimensional; lophids low, weak, rising to bulbous cusps; mesolophids short, low; talonid basins displaced toward posterior ends of teeth; posterior cingula short, compressed; $P_{\overline{4}}$ outline triangular, anterior spur from protoconid nearly reaching metaconid; $M_{\overline{1}}$ nearly square in outline; anterior and posterior valleys very shallow, anterior cingulum connected to protoconid and free at both ends.

Diagnosis of species: As for genus.

Holotype: L. mandibular fragment with $P_{\overline{4}}$-$M_{\overline{1}}$, alveoli for $M_{\overline{2}-\overline{3}}$, P661.101 (Fig. 5B,C).

Referred specimens: $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.286-287; $RM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.288.

Description: Teeth are brachydont but higher-crowned than in *Adjidaumo*, with low, weak lophids rising to bulbous cusps, and short, low mesolophids. Talonid basins are displaced toward the posterior ends of the teeth, and posterior cingula are short and lie very close to the hypolophids. Size is similar to that of the holotype of *Protadjidaumo typus* (Burke 1934, p.394), and the teeth are nearly as broad as long.

The mandible appears to have been stouter than in *Adjidaumo minimus*. Alveolar length of P661.101, 5.0.

$P_{\overline{4}}$ is nearly triangular in outline. The triangular metaconid is larger, and was apparently higher, than the circular protoconid. A short anterior spur from the

protoconid nearly reaches the metaconid, enclosing the trigonid basin anteriorly. The short, low mesolophid originates near the anterior end of the hypoconid. A cuspule between the metaconid and entoconid nearly blocks the central valley.

$M_{\overline{1}}$ of the holotype shows a hypolophid broader than the metalophid. The posterior cingulum runs transversely from the lingual end of the hypoconid to the base of the entoconid, enclosing an anteriorly-compressed valley that is much shallower than the central valley. A short, low mesolophid originates near the anterior end of the hypoconid, running linguad. The short anterior cingulum is attached directly to the protoconid, is free at both ends, and encloses an extremely shallow, anterolingually-directed anterior valley.

Three referred $M_{\overline{1}}$ or $M_{\overline{2}}$ (Fig. 5D-E) are similar in pattern to $M_{\overline{1}}$ of the holotype, differing only in showing a deeper crown pattern. P1585.287 and P1585.288 have small hypoconulids, from which the posterior cingula arose.

Disucssion: The specimens at hand differ markedly from described Eocene-Oligocene genera of brachydont eomyids, and are thus placed in a new genus. It is unfortunate that the mandible of the holotype is not complete enough for comparison with other genera. Cupressimus barbarae is a rare species at Calf Creek, comprising less than 1% of the rodent specimens.

Cupressimus is distinct from Protadjidaumo: P. typus has low lophids, but shows sharp cusps, greater length than width, and anteroposteriorly elongate anterior and posterior cingula. Cupressimus is clearly distinct from Adjidaumo, in which "The anterior and

posterior valleys are approximately as deep as the central valley. The anterior cingulum is connected with the middle of the metalophid, rather than with the protoconid as in Paradjidaumo. The talonid and trigonid of $M_{\overline{1}}$ have the same width." (Wood 1937, p.236). Paradjidaumo is distinctly higher crowned, with more prominent mesolophids and posterior cingula, and anterior cingula not developed buccally.

Cupressimus does not show the anteroposterior elongation of tooth crowns seen in Namatomys, nor does it show the central ectolophid position or posterior protoconid arm of that genus. Centimanomys has anterior, posterior, and central valleys of equal depth, strong mesolophids, more prominent posterior cingula, and anterior cingula with no buccal development. Yoderimys shows elongate crowns, central ectolophids, strong posterior cingula, anterior cingula attached to the centres of the metalophids, and quite different hypoconid-entoconid and protoconid-metaconid connections. Meliakrouniomys has no anteroposterior connections between lophids.

Viejadjidaumo shows many similarities, including size, to Cupressimus, but I feel that the weakness of the hypoconid-entoconid connection in $P_{\overline{4}}$, ectolophid-protoconid connection at the lingual margin of $M_{\overline{1}-\overline{2}}$, and absence of the posterior cingulum in $M_{\overline{1}-\overline{2}}$ of Viejadjidaumo rule out assignment of the Calf Creek specimens to that genus.

Aulolithomys is also generally similar to Cupressimus in tooth pattern, but is somewhat more massive, with stronger ridges and more prominent posterior cingula.

Cupressimus, while obviously separate from other genera, strikes me as representing merely one more aspect of the early Oligocene eomyid radiation. It is not a radical departure from other lines, and may be viewed as a member of the Adjidaumo-Paradjidaumo group (Fahlbusch 1973) that developed roughly parallel to Aulolithomys.

Measurements: Holotype, $P_{\overline{4}}$, AP, 1.14; BL met, 0.93; BL hyp, 1.09; $M_{\overline{1}}$, AP, 1.20; BL met, 1.17; BL hyp, 1.19. Referred $M_{\overline{1}}$ or $M_{\overline{2}}$: AP(3) mean 1.23, OR 1.18-1.29; BL met (3), mean 1.34, OR 1.17-1.50; BL hyp (3), mean 1.30, OR 1.19-1.47.

Paradjidaumo hansonorum (Russell) 1972
Adjidaumo hansonorum Russell 1972, pp.38-40

Referred specimens: $LP^{\overline{4}}$, P661.102, P1585.289-302; $RP^{\overline{4}}$, P1585.303-312; $LM^{\overline{1}}$ or $M^{\overline{2}}$, P1585.313-332; $RM^{\overline{1}}$ or $M^{\overline{2}}$, P661.103, P1585.333-354; $LM^{\overline{3}}$, P1585.355; R. maxillary fragment with $P^{\overline{4}}$, alveolus for $M^{\overline{1}}$, P661.104-105; R. maxillary fragment with $M^{\overline{1-2}}$, alveolus for $P^{\overline{4}}$, P661.106; $LdP_{\overline{4}}$, P1585.356; $RdP_{\overline{4}}$, P1585.358; $LP_{\overline{4}}$, P1585.359-367; $RP_{\overline{4}}$, P661.107, P1585.357, P1585.368-380; $LM_{\overline{1}}$ or $M_{\overline{2}}$, P661.108, P1585.381-407; $RM_{\overline{1}}$ or $M_{\overline{2}}$, P661.109, P1585.408-428; $LM_{\overline{3}}$, P1585.429-430; R. mandibular fragment with $P_{\overline{4}}$, P661.110-111; L. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.112; R. mandibular fragment with $I_{\overline{1}}$, alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.113-114, L. mandibular fragment with alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.115, P661.117; L. mandibular fragment with alveoli for $P_{\overline{4}}$-$M_{\overline{2}}$, P661.116; R. mandibular fragment with alveoli for $P_{\overline{4}}$-$M_{\overline{3}}$, P661.118, P661.121-122;

L. mandibular fragment with alveolus for $P_{\overline{4}}$, P661.119,
R. mandibular fragment with alveolus for $P_{\overline{4}}$, P661.120.

Diagnosis: Occlusal pattern of teeth, mandible size and shape as in Paradjidaumo minor; $P_{\overline{4}}$ nearly square in occlusal outline; $P\frac{4}{4}$ longer anteroposteriorly, about as broad buccolingually as $M\frac{1-2}{1-2}$.

Description: Russell (1972, pp.38-40) has described teeth (as Adjidaumo hansonorum) for most positions. Black's description (1965, pp.26-28) of teeth of Paradjidaumo minor applies to these teeth as well, for details of occlusal pattern.

Discussion: I see no feature of occlusal pattern to distinguish these teeth (Fig. 6A-G) from those of Paradjidaumo minor, and the mandible is nearly identical (fig. 6H).

However, in this sample $P\frac{4}{4}$ average longer anteroposteriorly than $M\frac{1-2}{1-2}$ (these teeth average about equal in P. minor), and nearly as broad bucolingually ($M\frac{1-2}{1-2}$ average distinctly broader buccolingually in P. minor than $P\frac{4}{4}$). The comparision is dangerous to make on the basis of isolated teeth, but samples of both upper and lower cheek teeth of P. hansonorum, and of lower cheek teeth of P. minor (see Black 1965, p.30) are sufficiently large that I believe the populations from Calf Creek and Pipestone Springs are separable on proportional size of $P\frac{4}{4}$.

I therefore regard Paradjidaumo hansonorum as a distinct species, with the realization that an excellent case could also be made for synonymizing it with P. minor, as a regional population, or reducing it to a subspecies of P. minor.

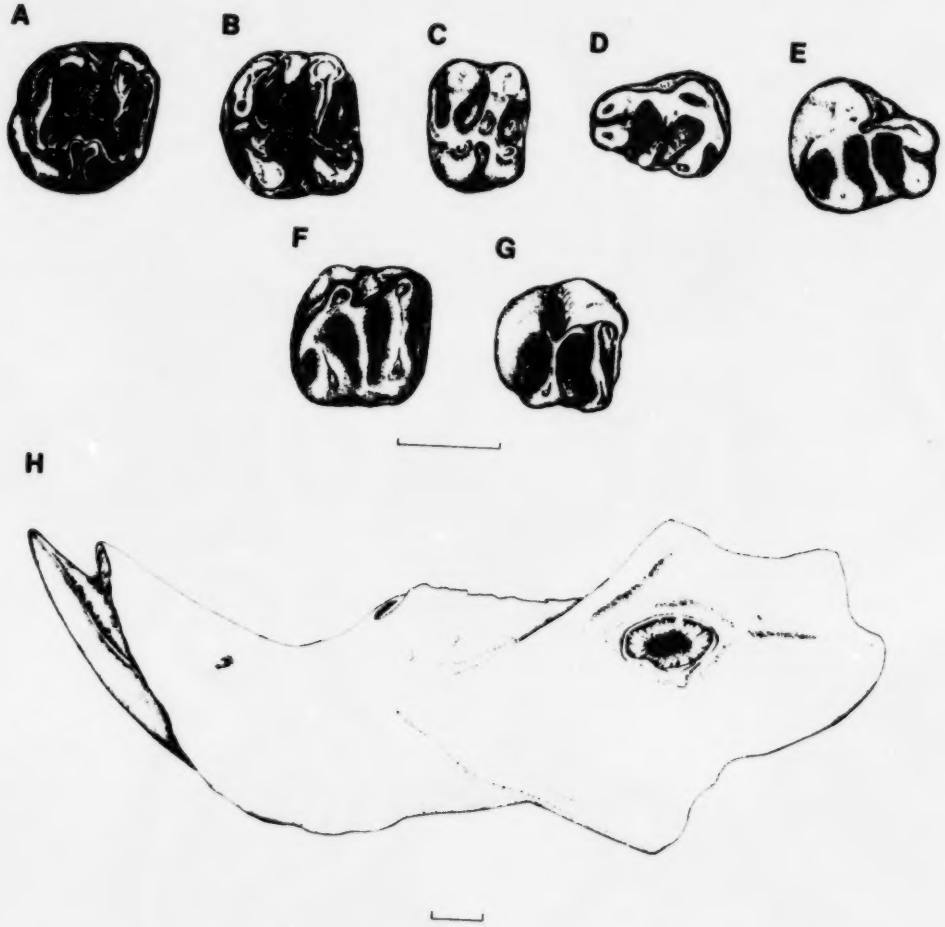

Fig. 6. Paradjidaumo hansonorum. Buccal to top of page in A-G, occlusal to top of page in H. Anterior to left in A-D, H, to right in E-G. Scales 1 mm. A, $LP^{\underline{4}}$, P1585.289; B, $LM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.319; C, $LM^{\underline{3}}$, P1585.355; D, $RdP_{\overline{4}}$, P1585.358; E, $LP_{\overline{4}}$, P1585.359; F, $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.390; G, $LM_{\overline{3}}$, P1585.430; H,L. mandibular fragment, P661.112 (lateral view).

Measurements: $P^{\underline{4}}$, AP(26), mean 1.42, OR 1.22-1.65, CV 7.04; BL(26), mean 1.46, OR 1.25-1.66, CV 6.16. $M^{\underline{1}}$, AP(1), 1.32; BL(1), 1.49. $M^{\underline{2}}$, AP(1), 1.22; BL (1), 1.51. $M^{\underline{1}}$ or $M^{\underline{2}}$, AP(41), mean 1.34, OR 1.15-1.45, CV 5.97: BL(40), mean 1.48, OR 1.31-1.68, CV 6.08. $M^{\underline{3}}$, AP(1), 1.03; BL(1), 1.16. $dP_{\overline{4}}$, AP(2), mean 1.28, OR 1.21-1.35; BL met (2), mean 0.84, OR 0.81-0.87; BL hyp (2), mean 1.00, OR 0.95-1.05. $P_{\overline{4}}$, AP(26), mean 1.51, OR 1.32-1.71, CV 7.28; BL met (25), mean 1.10, OR 0.96-1.20, CV 7.27; BL hyp (25), mean 1.33, OR 1.14-1.45, CV 6.02. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(46), mean 1.35, OR 1.14-1.65, CV 7.41; BL(46), mean 1.41, OR 1.23-1.60, CV 5.67. $M_{\overline{3}}$, AP(2), mean 1.26, OR 1.25-1.26; BL9@), mean 1.30, OR 1.27-1.33.

Aulolithomys bounites Black 1965

Referred specimens: $LP^{\underline{4}}$, P1585.431-434; $LM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.435-439; $RM^{\underline{1}}$ or $M^{\underline{2}}$, P1585.440, P1585.442, P1585.446; $LM^{\underline{3}}$, P1585.443-445; $RM^{\underline{3}}$, P1585.447; $LP_{\overline{4}}$, P1585.448-449; $RP_{\overline{4}}$, P1585.450; $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.441, P1585.451-463; $RM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.464-471; $LM_{\overline{3}}$, P1585.472-473; $RM_{\overline{3}}$; P1585.474; R. mandibular fragment with alveoli for $P_{\overline{4}}$, $M_{\overline{1}}$, P661.123.

Description: Premolars (Fig. 7A,D) assigned to this species are relatively small. Cheek teeth are distinguished by brachydont crowns, short anterior and posterior cingula, $M^{\underline{1-2}}_{\overline{1-2}}$ generally wider than long, bulbous cusps, and short,

free mesolophs and mesolophids that dip steeply into the central valleys.

Discussion: These teeth (Fig. 7) are similar in all visible details to specimens of Aulolithomys bounites described by Black (1965, pp.35-38) and Wood (1974, pp.73-77). Unfortunately, the referred Calf Creek mandible is too fragmentary to yield useful measurements.

Measurements: $P^{\underline{4}}$, AP(4), mean 1.58, OR 1.50-1.65; BL(4), mean 1.64, OR 1.52-1.80. $M^{\underline{1}}$ or $M^{\underline{2}}$, AP(5), mean 1.67, OR 1.50-1.80, CV 8.31; BL(5), mean 1.95, OR 1.80-2.19, CV 7.21. $M^{\underline{3}}$, AP(4), mean 1.51, OR 1.26-1.62; BL(4), mean 1.50, OR 1.38-1.59. $P_{\overline{4}}$, AP(1), 1.53; BL met (1), 1.09; BL hyp (3) mean 1.46, OR 1.34-1.58. $M_{\overline{1}}$ or $M_{\overline{2}}$, AP(19), mean 1.73, OR 1.67-1.84, CV 4.54; BL met (20), mean 1.79, OR 1.65-2.01, CV 5.96: BL hyp (21), mean 1.82, OR 1.64-2.03, CV 5.46. $M_{\overline{3}}$, AP(2), mean 1.74, OR 1.62-1.86; BL met (2), mean 1.72, OR 1.62-1.82; BL hyp (3), mean 1.64, OR 1.48-1.80.

Yoderimys stewarti (Russell) 1972

Adjidaumo stewarti Russell 1972, pp.37-38

Holotype: L. maxillary fragment with $P^{\underline{4}}$-$M^{\underline{2}}$, ROM 6317.

Referred specimens: $LM^{\underline{1}}$ or $M^{\underline{2}}$, P661.124; $RM^{\underline{1}}$ or $M^{\underline{2}}$, P661.125, P1585.475; $LP_{\overline{4}}$, P661.126, P1585.476; $RP_{\overline{4}}$, P661.127-128, P1585.477; $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.478-481; $RM_{\overline{1}}$ or $M_{\overline{2}}$, P661.129, P1585.482-487; $RM_{\overline{3}}$, P1585.488; R. mandibular fragment with $P_{\overline{4}}$, $M_{\overline{2}}$, alveoli for $M_{\overline{1}}$, $M_{\overline{3}}$, P661.130.

Emended diagnosis: Larger than Yoderimys bumpi, Y. lustrorum, lower molars smaller than in Y. burkei; $P^{\underline{4}}$

Fig. 7. Aulolithomys bounites. Buccal to top of page, anterior to left in A-C, to right in D-F. Scale 1 mm.
A, $LP^{\overline{4}}$, P1585.431; B, $LM^{\overline{1}}$ or $M^{\overline{2}}$, P1585.438; C, $LM^{\overline{3}}$, P1585.444; D, $LP_{\overline{4}}$, P1585.449; E, $LM_{\overline{1}}$ or $M_{\overline{2}}$, P1585.452; F, $LM_{\overline{3}}$, P1585.473.

approximately same size as $M^{\frac{1}{-}}$; upper cheek teeth with well-developed ridge and mesostyle blocking median valley buccally, prominent shelf buccal to ridge; posterior cingulum high, strong buccally, curved posterad, connecting strongly with metacone, and lower but strong lingually, connecting to base of hypocone; anterior cingulum high, strong at connection with paracone, low but still strong at connection with base of protocone, low but still strong at connection with base of protocone; lingual cingulum connects protocone and hypocone, lower cheek teeth relatively short anteroposteriorly, with shelf-like, anteroposteriorly elongate buccal valley, sometimes closed by buccal cingulum, strong ectolophids, length of mesolophid and buccally-directed accessory lophid variable; $P_{\frac{-}{4}}$ metalophid high, anteroconid large, usually connected to both protoconid and metaconid, posterior cingulum strong; $M_{\frac{-}{1-2}}$ posterior cingulum connecting strongly to entoconid, anterior cingulum connecting strongly to protoconid and metaconid; $M_{\frac{-}{3}}$ anterior cingulum very strong and prominent; diastema of mandible curved sharply ventrad anterior to $P_{\frac{-}{4}}$, mandible not as stout as in Y. burkei, stouter than in Y. lustrorum.

Description: From the holotype it appears that $P^{\frac{4}{-}}$ is approximately the same size as $M^{\frac{1}{-}}$. Upper cheek teeth (Fig. 8A,B) show extremely strong cingula on all sides, and mesostyles are consistently present. A prominent shelf is present at the buccal edge of all upper cheek teeth. Mesolophs are of variable strength. Russell (1972, p.38) has described upper teeth of this species, and has provided excellent photographs (1972, fig. 10C,D).

The only preserved mandible, P661.130 (Fig. 8L,M), is deep and stout, more so than in Yoderimys lustrorum, and

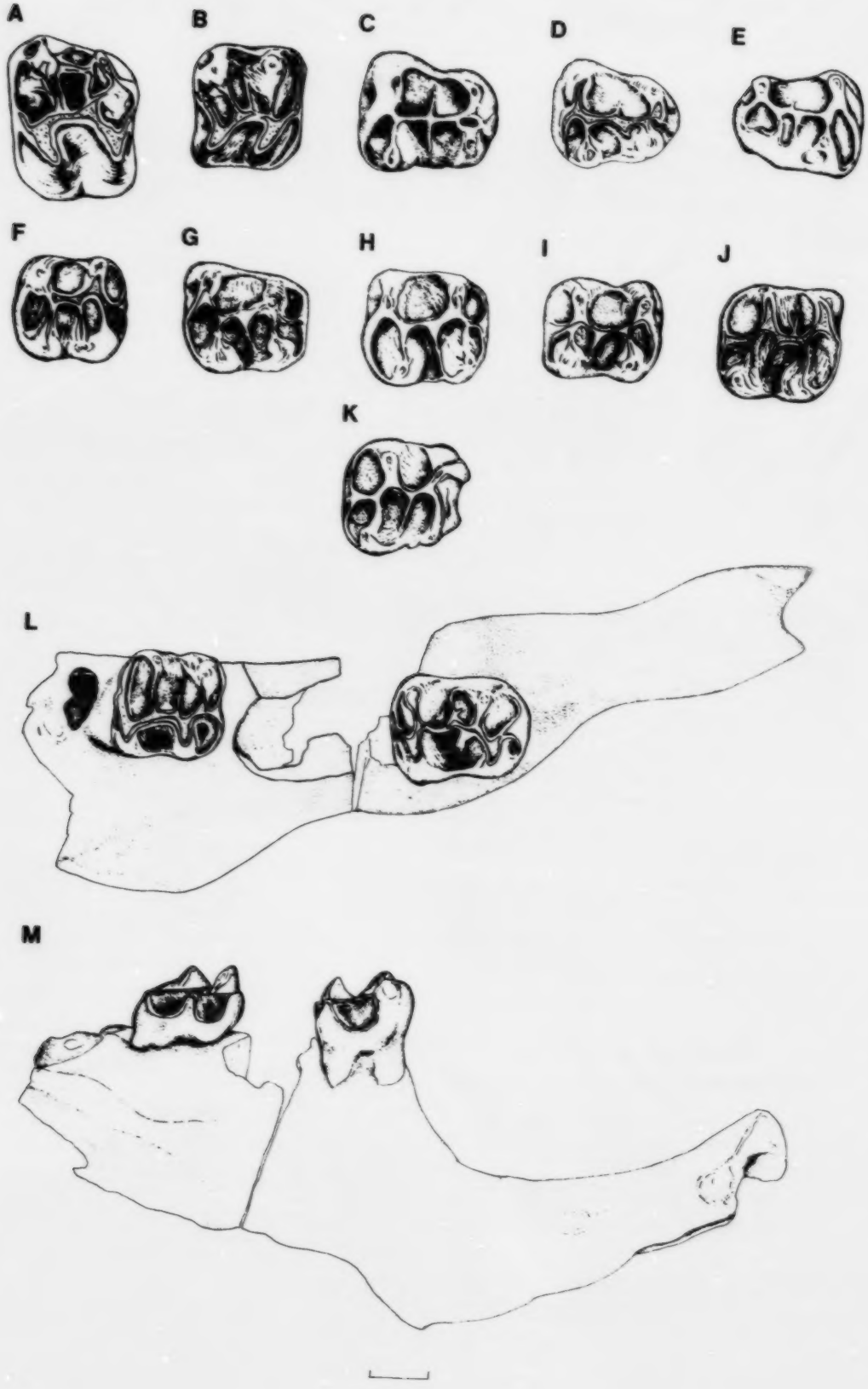
A
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Fig. 8. Yoderimys stewarti. Buccal to top of page in A-K, to bottom of page in L, occlusal to top of page in M. Anterior to left in A,E, I-K, to right in B-D, F-H,L,M. Scale 1 mm. A, $LM^{\frac{1}{-}}$ or $M^{\frac{2}{-}}$, P661.124; B, $RM^{\frac{1}{-}}$ or $M^{\frac{2}{-}}$, P1585.475; C, $LP_{\frac{-}{4}}$, P661.126; D, $LP_{\frac{-}{4}}$, P185.476; E, $RP_{\frac{-}{4}}$, P661.127; F, $LM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P1585.478; G, $LM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P1585.479; H, $LM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P1585.480; I, $RM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P1585.484; J, $RM_{\frac{-}{1}}$ or $M_{\frac{-}{2}}$, P1585.485; K, $RM_{\frac{-}{3}}$, P1585.488. L,M. R. mandibular fragment with $RP_{\frac{-}{4}}$, $RM_{\frac{-}{2}}$, P661.130. L, occlusal view; M, lateral view.

less than in Y. burkei. The diastema dips sharply ventrad anterior to $P_{\overline{4}}$, more sharply and deeply than in Y. lustrorum and less so than in Y. burkei. The mental foramen lies nearly a third of the way forward from $P_{\overline{4}}$, and is near the dorsal border of the ramus.

In $P_{\overline{4}}$ (Fig. 8C-E), the metalophid is high, and the anteroconid large, with a short anterior cingulum, free at both ends. The anteroconid is connected strongly to the protoconid and less strongly to the metaconid, enclosing an anterolingually-directed valley, except in P661.127, in which the anteroconid and metaconid are not connected. The ectolophid is strong, and the length of the mesolophid and a buccally directed accessory lophid are variable. The buccal valley is anteroposteriorly elongate, and is shelf-like. The posterior cingulum is strong. It is free at its lingual end, extending weakly buccally to the base of the hypoconid. A week mesostylid is present on P661.127.

The posterior cingulum of $M_{\overline{1}}$ and $M_{\overline{2}}$ (Fig. 1F-J) is connected strongly to the entoconid, and the anterior cingulum connects strongly to the protoconid and the base of the metaconid. A cingulum blocks the anteroposteriorly elongate, shelf-like buccal valley in some specimens. Mesolophids are strong. Metalophids are weak in some teeth, strong in others.

$M_{\overline{3}}$, P1585.488 (Fig. 8K) is broken. It is relatively broad in relation to $M_{\overline{1-2}}$. The anterior cingulum is very strong and prominent, and the mesolophid is strong.

Discussion: This species is readily distinguishable from previously described Yoderimys. It is intermediate in size

and mandibular proportion between the earliest known Yoderimys, Y. lustrorum, and the latest, Y. burkei.

Upper teeth resemble those of Y. bumpi (Wood 1955) in having strong cingula, mesostyles, and strong shelves at the buccal edges.

Measurements presented here do not include the ROM specimens described by Russell, but are restricted to SMNH specimens from the Calf Creek local fauna.

Measurements: $M^{\frac{1}{2}}$ or $M^{\frac{2}{2}}$, AP(3), mean 1.95, OR 1.81-2.17; BL(2), mean 2.23, OR 2.01-2.45. $P_{\frac{4}{4}}$, AP(4), mean 2.24, OR 2.12-2.34; BL met (6), mean 1.60, OR 1.50-1.89, CV 9.38; BL hyp (5), mean 1.99, OR 1.84-2.38, CV 11.06. $M_{\frac{1}{1}}$ or $M_{\frac{2}{2}}$, AP(11), mean 1.99, OR 1.70-2.15, CV 6.53; BL met (9), mean 1.71, OR 1.48-1.88, CV 7.60; BL hyp (9), mean 1.78, OR 1.54-1.92, CV 6.74. $M_{\frac{3}{3}}$, BL met (1), 1.80.

Eomyidae, gen. et sp. indet.

Referred specimens: L. mandibular fragment with $I_{\frac{1}{1}}$, alveoli for $P_{\frac{4}{4}}$-$M_{\frac{3}{3}}$, P661.131; L. mandibular fragment with alveoli for $P_{\frac{4}{4}}$-$M_{\frac{3}{3}}$, P661.132; R. mandibular fragment with alveoli for $P_{\frac{4}{4}}$-$M_{\frac{3}{3}}$, P661.133.

Description: The mandible (Fig. 9) is proportionally deep, with a short, sharply downcurved diastema. The anterior end of the masseteric fossa, at the anterior end of the ventral masseteric ridge, is swollen, and lies at about the middle of $P_{\frac{4}{4}}$. The mental foramen is set about a third of the way down the jaw, closer to $P_{\frac{4}{4}}$ than to the incisor.

The incisor is narrow, with a rounded anterior face

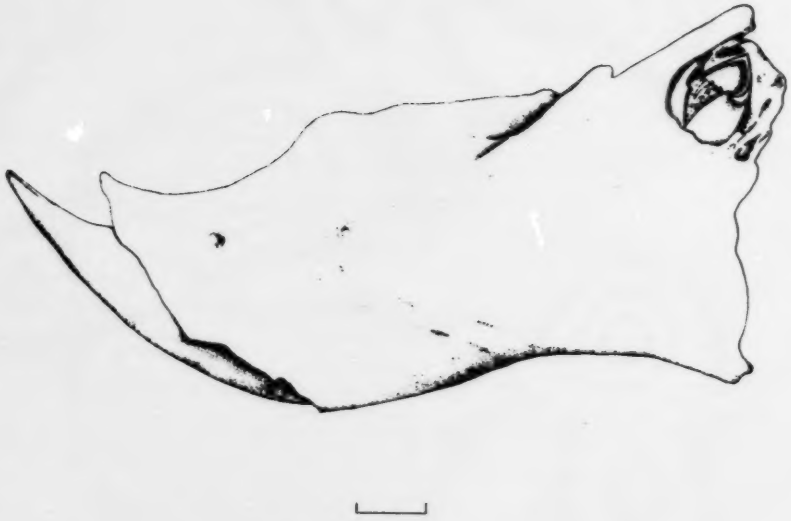

Fig. 9. Eomyidae, gen. et sp. indet. L. mandibular fragment, P661.131, lateral view. Occlusal to top of page, anterior to left. Scale 1 mm.

and slit-like pulp cavity. Enamel covers nearly half the lateral surface, and does not overlap onto the medial surface. Weak longitudinal striations are present on the anterior enamel face.

Discussion: An eomyid about the size of Adjidaumo minimus is represented by these three mandibular fragments, without cheek teeth.

These mandibles resemble Namatomys (Black 1965, p.34) in being dorsoventrally deep, with short, deep diastemata and mental foramina set low on the jaw and well back toward $P_{\overline{4}}$. The jaws are smaller than those designated N. lloydi.

Measurements: Mandible, alveolar length $P_{\overline{4}}$-$M_{\overline{3}}$ (3), mean 4.2, OR 4.04-4.4; length of diastema (1), 2.8; depth below $M_{\overline{1}}$ (2), mean 3.6, OR 3.4-3.8.

Family Heteromyidae

Heliscomys cf. H. vetus Cope 1873

Referred specimens: L. mandibular fragment with $M_{\overline{1}}$, alveolus for $P_{\overline{4}}$, P661.134; R. mandibular fragment with alveoli for $P_{\overline{4}}$-$M_{\overline{1}}$, P661.135.

Description: In $M_{\overline{1}}$ (Fig. 10A), the anterior cingulum is strongly connected to the protostylid, and a ridge reaches anterolinguad from the protoconid to meet the anterior cingulum. The posterior cingulum is weak. Measurements: AP, 0.90; BL met, 0.88; BL hyp, 0.89.

The mandible is basically as Black (1965, p.43) described for Pipestone Springs material. The mental foramen is just below the dorsal border of the mandible, immediately anterior to the end of the masseteric ridge.

Fig. 10. Heliscomys, Castoridae, and Eutypomys. Buccal to top of page, anterior to left in B,C, to right in A. Scale 1 mm.

A. Heliscomys cf. H. vetus. $LM_{\overline{1}}$, P661.134

B. Castoridae, gen. et sp. indet. $RM_{\overline{1}}$ or $M_{\overline{2}}$, P661.136.

C. Eutypomys parvus. $LP^{\overline{4}}$, P661.137.

Discussion: The Calf Creek specimens evidently represent a Heliscomys close to H. vetus, but the present material is insufficient for definite identification.

Family Castoridae

Castoridae, gen. et sp. indet.

Eumys pristinus (Part)? Russell, p.41; fig. 11A

Referred specimen: $RM_{\overline{1}}$ or $M_{\overline{2}}$, P661.136 (Fig. 10B).

Tentatively referred: $?LM^{\overline{3}}$, ROM 6326

Description: The largest cusps are the protoconid and hypoconid, both of which are directed posterolingually. A strong ectolophid connects the protoconid and hypoconid, and bears a large, diamond-shaped mesoconid. A strong mesolophid connects the mesoconid and mesostylid. It is directed transversely at its lingual and buccal ends, curves anterad medially, and encloses a shallow, transversely-elongate fossettid just buccal to the mesostylid.

The protoconid and metaconid are joined by a strong anterior cingulum, and the posterolingually directed metaconid sends a short rounded spur into the metafossettid (see Storer 1975, figs. 77A-B). This spur would become part of the metalophid in very late wear. The metastylid is fused into the metaconid. The Y-shaped metafossettid is shallow lingually and very deep buccally. Its anterior arm is shallow and is cut off by a high ridge from the rest of the fossettid.

The hypoconid and entoconid are connected by a strong, medially constricted hypolophid that runs anterolinguad. A strong cross-connection between the hypolophid and mesolophid isolates an oval fossettid that is very deep.

The entoconid is oriented nearly buccolingually and sends a sharp spur anterad into the mesoflexid.

A posterior cingulum joins the entoconid, isolating a transversely elongate metafossettid that is divided into two shallow fossettids by a low, anterposterior cross connection. A low, irregular cingulum occupies the posterobuccal surface of the hypoconid.

The deepest valley is the hypoflexid, which is open to within 0.6 mm of the crown base. It is evident from the crown pattern that the mesoflexid was about as deep as the metaflexid at the lingual crown border. The hypoflexid axis is oriented roughly transversely.

Measurements: AP, 2.39; BL met, 2.58; BL hyp, 2.64; height of crown at metaconid, 1.11.

Discussion: This tooth represents a castorid, but is quite different from all previously described genera and species. Its transversely directed hypoflexid, large mesoconid, and relatively shallow mesoflexid at the lingual crown surface, set it apart from any other known Oligocene or Miocene beaver.

Although the specimen clearly represents an undescribed genus and species, I am unwilling to name it because the material is so scanty.

ROM 6326 is tentatively referred to this taxon, as $LM_{=}^{3}$. Worn but hyposodont, as Russell (1972, p.41) has remarked (height of crown at hypocone, 2.28) this tooth shows no trace of the unilateral hypsodonty seen in contemporaneous cylindrodontids. One large root is split into three portions beneath the protocone, paracone, and hypocone. Anterior and lingual valleys extend to the base of the root. Russell (op. cit., pp.41-42) has des-

cribed the crown pattern and has given crown measurements (AP, 2.32; BL. 2.00).

This specimen makes a rather unlikely beaver tooth, but I feel the assignment is far less unlikely than the other contemporaneous rodent groups. The tooth is certainly too high crowned to represent Eumys, the taxon to which Russell (loc. cit.) referred it. Eumys has not been discovered in the Calf Creek local fauna, although Eumys pristinus, a valid species, occurs at several other localities in Calf Creek and Conglomerate Creek valleys.

Family Eutypomyidae

Eutypomys parvus Lambe 1908

Referred specimens: $LP^{\frac{4}{}}$, P661.137; $LM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P1585.489; $RM^{\frac{1}{}}$ or $M^{\frac{2}{}}$, P661.138, P1585.490; $LP_{\frac{4}{}}$ P1585.491; $RM_{\frac{1}{}}$ or $M_{\frac{2}{}}$, P661.139.

Description: $P^{\frac{4}{}}$ (Fig. 10C) is nearly unworn. Wood's description (1937, pp.224-225) of the pattern of $P^{\frac{4}{}}$ in Eutypomys thomsoni applies to this tooth as well. P661.137 shows a very strong posterior cingulum enclosing an oval area, posterior to the metaloph, that is longer anteroposteriorly than in E. thomsoni. From a point on the metaloph just lingual to the metacone, two strong cross-connections extend to the posterior cingulum, one oriented posterad, the other posterolinguad. Measurements: AP, 2.73; BL, 2.45.

Three examples of $M^{\frac{1}{}}$ or $M^{\frac{2}{}}$ are at hand, all worn and broken. The best of these, P1585.490, resembles Russell's referred specimen ROM 9197 (1972, fig. 9H) in pattern. Measurements: P1585.490, AP, 2.15; BL, 2.61. P661.138 and P1585.489, AP(2), mean 2.52, OR 2.19-2.85; BL(1), 2.70.

$P_{\overline{4}}$, P1585.491, is heavily worn, but is shows the strong posterior cingulum connecting with the large, anteroposteriorly elongate entoconid, the heavy, straight hypolophid, the slender sinuous mesolophid, and the complex trigonid basin. Measurements: AP, 1.98; BL met, 1.59; BL hyp, 1.71.

A broken $M_{\overline{1}}$ or $M_{\overline{2}}$ resembles, in its visible details, ROM 6313 (Russell 1972, fig. 9K), and Russell's description (1972, pp.35-36) applies. Measurements: AP, 2.97; BL met, 2.70.

Discussion: These specimens add little to our knowledge of the species, except to point up the similarity of $P_{\overline{4}}$ pattern to that of E. thomsoni. E. parvus is distinguished mainly by its small size.

CONTENT OF FAUNA AND CORRELATION

Seventeen taxa of rodents are represented in the Calf Creek local fauna. The local fauna rodents are:

Family Ischyromyidae

Leptotomus guildayi Black

Ischyromys junctus Russell

Ischyromyidae, gen. et sp. indet.

Family Cylindrodontidae

Pseudocylindrodon neglectus Burke

Cylindrodon collinus Russell

Ardynomys saskatchewensis (Lambe)

Family Aplodontidae

Prosciurus vetustus Matthew

Family Sciuridae

Protosciurus jeffersoni (Douglass)

Family Eomyidae

Adjidaumo minimus (Matthew)

Cupressimus barbarae, gen. et sp. nov.

Paradjidaumo hansonorum (Russell)

Aulolithomys bounites Black

Yoderimys stewarti (Russell)

Eomyidae, gen. et sp. indet.

Family Heteromyidae

Heliscomys cf. *H. vetus* Cope

Family Castoridae

Castoridae, gen. et sp. indet.

Family Eutypomyidae

Eutypomys parvus Lambe

Rodents of the Calf Creek local fauna appear to indicate an age late in the early Chadronian (lower Oligocene), definitely earlier than the middle Chadronian Pipestone Springs local fauna of Montana. The local fauna can be no earlier than the McCarty's Mountain local fauna of Montana.

Correlation of the Calf Creek local fauna on the basis of rodents is difficult. There are several early and middle Chadronian faunas that show similarities to this assemblage: most of these similarities are of doubtful significance.

Five Calf Creek species (those of *Pseudocylindrodon*, *Prosciurus*, *Protosciurus*, *Adjidaumo*, and *Aulolithomys*) are identical to those of the Pipestone Springs local fauna, middle Chadronian of Montana. But three of these species also occur in the very early Chadronian. *Pseudocylindrodon neglectus* and *Aulolithomys bounites*

make their first appearance in the Porvenir local fauna, Vieja Group of Texas (Wood 1974), and Prosciurus vetustus is found in the Pilgrim Creek local fauna of Wyoming (Sutton and Black 1975). Both local faunas are considered to date near the Eocene-Oligocene boundary.

Presence of Protosciurus jeffersoni offers the strongest resemblance to the Pipestone Springs local fauna. This species has previously been identified only from Pipestone.

Adjidaumo minimus has also been identified only from Pipestone, but I doubt that its presence at Calf Creek is a strong indicator of correlation. Wood (1974, pp.62-63) has recorded Adjidaumo cf. A. minutus, a more "advanced" species, from the Porvenir local fauna, which is much earlier than Pipestone.

Although the Calf Creek local fauna strongly resembles the Pipestone Springs local fauna, I think that it does so because both contain typical long-ranging species of the early and middle Chadronian.

Other Calf Creek species, while not identical with taxa from pre-Pipestone fauna, suggest an age older than that of the Pipestone Springs local fauna.

Ischyromys junctus is as "primitive" as I. blacki from the Porvenir, and slightly more "primitive" than I. douglassi from McCarty's Mountain. Leptotomus has not been identified from deposits later than earliest Chadronian. Yoderimys stewarti is intermediate in size and mandibular proportion between the earliest known Yoderimys, Y. lustrorum from Porvenir, and the latest, Y. burkei from Pipestone.

It is difficult to make a detailed comparison with the early Chadronian McCarty's Mountain local fauna of Montana. Ischyromys douglassi, an Ischyromys nearly as "primitive" as I. junctus, is present there, and Ardynomys occidentalis is at a similar stage of evolution to the Cypress Hills A. saskatchewensis.

The Calf Creek rodent assemblage does not compare usefully with other pre-Pipestone faunas (Yoder Formation fauna; Little Egypt and Airstrip local faunas of the Vieja Group).

Against the referees' advice, I conclude that the Calf Creek local fauna is intermediate in age between the Porvenir local fauna, Vieja Group of Texas (Wood 1974) and the Pipestone Springs local fauna of Montana (Black 1965). I suspect, because the Calf Creek local fauna contains a "primitive" Ischyromys, Ardynomys, and Leptotomus, that it is early Chadronian.

The intermediate nature of Yoderimys stewarti suggests that the local fauna age lies between those of the Porvenir and Pipestone assemblages. Presence of Protosciurus jeffersoni, and sparse representation of ischyromyids with Eocene affinities, lead me to conclude that the Calf Creek local fauna is probably late early Chadronian.

Other evidence indicates that the Calf Creek local fauna cannot be much older than the McCarty's Mountain local fauna. Bruce Lander (U.S. Geological Survey, Menlo Park, California) has identified the oreodont jaw (P1063.2) from SMNH Locality 6, and stated (pers. comm. 1978) "The dentary is from an animal so large that it can only be what Douglass (1907) called Merycoidodon macrorhinus.... This taxon is found at Pipestone Springs and Hunter Quarry..., but is also found at McCarty's Mountain and

other localities of similar age.... It does not occur in older units, where a different '*Merycoidodon*' is found...."

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Some changes in my original view of local fauna correlation arose from the kind co-operation of Dr. Bruce Lander, U.S. Geological Survey, Paleontology/Stratigraphy Branch, Menlo Park, California. Any pecularities in correlation are my own, however.

I am particularly indebted to Mr. James S. McLean, the illustrator, for his skill and co-operation.

Miss Terri Pana typed the manuscript.

This project would not have been possible without the efforts of the collectors, particularly McCorquodale, Swanston, and Weigel. Their massive collecting effort has made possible a better understanding of Saskatchewan's most diverse vertebrate fauna.

My thanks also are due to the referees for the contribution, who have attempted to make this a better paper. They are responsible for many improvements, and for none of the faults.

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